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numerical example, I obtained for the curtate distance the value 1·20181; employing the factor $\frac{\theta\theta''}{2}$, I obtained 1·24994. Now the exact value is 1·20151. I have given the details of this case in the preface to the tables which I have sent to the *Astronomische Nachrichten.*'"

Simple Method of Finding the Focal Length of small Convex Lenses. By the Rev. T. W. Webb.

The determination of the focal length of a small convex lens is a matter of considerable difficulty, at least in the hands of an amateur. Not only is the process of direct measurement a delicate and somewhat troublesome one, but the result is not satisfactory, as it is complicated with uncertainties arising from the amount of spherical aberration, which with a large angle of aperture may have a considerable effect; from the thickness of the lens; and from the difference of the measure from the centre and from the margin of the posterior surface.

These difficulties, it is true, are avoided, as to the usual object of such measurements, by the employment of the dynameter, or any equivalent contrivance by which the focal image is measured instead of the focal length; but, as these optical means are not always at hand, it may perhaps be of some use to explain a mode of measurement practised by myself very successfully more than twenty years ago. The requisite apparatus, if it can be so termed, will be described in its original simplicity; a little ingenuity would easily improve it; but even in its first rude trial it was found adequate to its object.

Three pieces of cork are perforated by a knitting-needle, so as to slide along it. To the centre one is attached, in a vertical position, and with its axis parallel to the knitting-needle, the lens to be measured; in each of the others is inserted a piece of a sewing-needle, with the point uppermost, and having its length so regulated that a line joining these points would pass, as nearly as may be, through the centre of the lens. The cork discs carrying these needles are then moved backwards and forwards, till the inverted image of the one needle's point, formed by rays passing through the lens, is seen coincident and equally distinct with the other needle's point, when both are viewed at once through a tolerably strong magnifier applied to the eye, and directed towards the lens. Then, if the needle-points are sensibly equidistant on each side of the lens, a condition which can be quite sufficiently attained in the course of a few trials, it is evident that they occupy the conjugate foci, and the distance between them being carefully measured with compasses will be, as a very simple proposition in optics will show, *four times the amount of the focal length of the lens for parallel rays.*

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The apparent defect of this method is the uncertainty whether the points, when the image of one is formed close to the other, are equidistant from the lens, the setting of which, or its form unless equally convex on each side, may render actual measurement unsatisfactory. A brief and simple calculation, however, founded upon Cor. 3 to Prop. xlv. of Wood's *Optics*, will show that any uncertainty in the focal length for parallel rays arising from this source of error would be so small in proportion to the corresponding change in the relative position of the conjugate foci, that the needle-points would be obviously and unmistakeably out of their proper places, that is, at very sensibly unequal distances from the lens, before the resulting focal length would be materially affected.

On the other hand, the advantages of this method are easily to be recognised. All errors are eliminated which arise from spherical aberration, the thickness of the lens, or the difference between the length of the marginal and that of the central ray; and the quantity actually measured, being four times greater than the final result, introduces into the latter a microscopical precision; while the actual process of measurement requires nothing but a careful eye, a steady hand, and a little experience, to ensure a degree of accuracy quite sufficient for all practical purposes.

Hardwick Parsonage, *Herefordshire*,
June 11, 1857.

Astronomical and Meteorological Observations made at the Radcliffe Observatory, Oxford, in the Year 1855, *under the Superintendence of Manuel J. Johnson, M.A., Radcliffe Observer.* Vol. XVI., Oxford, 1856.

The first part of this volume consists as usual of the meridian observations, with the necessary elements for reduction. Then follows a catalogue of stars observed in the year 1855, showing the result of each individual observation. This is succeeded by a catalogue of final results, exhibiting the places of 1149 stars reduced to the beginning of the year 1860, and a catalogue of 164 stars within 6° of the North Pole. The latter contains the mean places of all the stars in the vicinity of the pole reduced to the beginning of 1855, which have been observed at the Radcliffe Observatory during the period comprised between 1840 and 1855, both years inclusive.

The second part of the volume is devoted to the observations with the heliometer and the investigation of the results deducible from them. The parallaxes of a few of the more interesting stars form the object of research. The stars selected are:—*Castor*; the star *b*, employed by Mr. Johnson in his investigation of the parallax of 1830 Groombridge, given in the fourteenth volume of the Radcliffe Observations; *Arcturus*; and, lastly, α *Lyræ*.

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